Few vs Many-Body Physics of an Impurity Immersed in a Superfluid of Spin 1/2 Attractive Fermions

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In this work, we investigate the properties of an impurity immersed in a superfluid of strongly correlated spin 1/2 fermions. For resonant interactions, we first relate the stability diagram of dimer and trimer states to the three-body problem for an impurity interacting with a pair of fermions. Then we calculate the beyond-mean-field corrections to the energy of a weakly interacting impurity. We show that these corrections are divergent and have to be regularised by properly accounting for three-body physics in the problem.